Design and Fabrication of Aerospace-Grade Digital Composite Materials

Completed Technology Project (2014 - 2017)

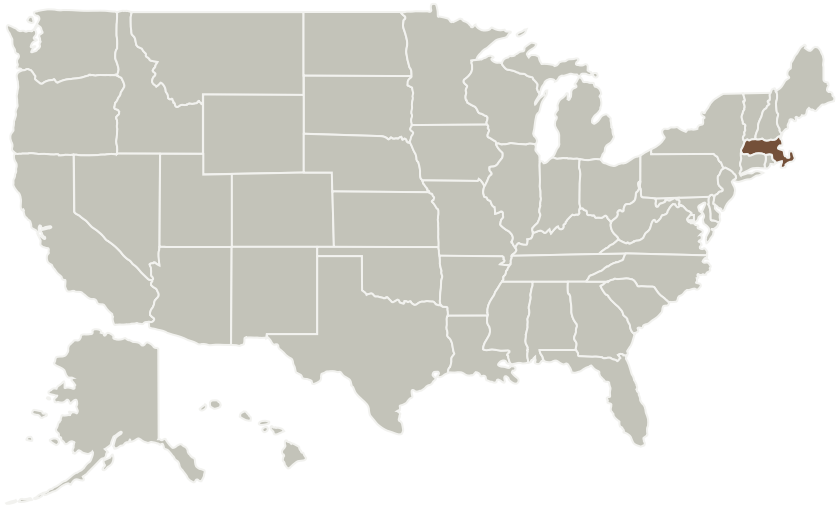
Project Introduction

This project aims to advance design rules and fabrication approaches to create aerospace-grade structures from digital composite materials. Digital materials are discrete building blocks that can be assembled in a scalable, rapid, and reversible manner. To date, however, demonstrated structures have primarily been restricted either in the use of high performance composite materials or in the topology of the assembled structure. We will address these shortcomings via computational and experimental investigation of 1-D fiber-reinforced struts that have increased specific stiffness and buckling resistance, and 2-D element populations to create structures with tunable and directional properties. The modular design of digital materials will be modeled and characterized in an effort to avoid costly and lengthy sub-component certification. Ultimately, the ability to repurpose defunct space structures through disassembly and subsequent assembly within a new, modular design will provide greater material efficiency and a more sustainable launch cost structure.

Anticipated Benefits

Ultimately, the ability to repurpose defunct space structures through disassembly and subsequent assembly within a new, modular design will provide greater material efficiency and a more sustainable launch cost structure.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
University of Massachusetts-Lowell	Lead Organization	Academia	Lowell, Massachusetts

Primary U.S. Work Locations
Massachusetts

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Massachusetts-Lowell

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

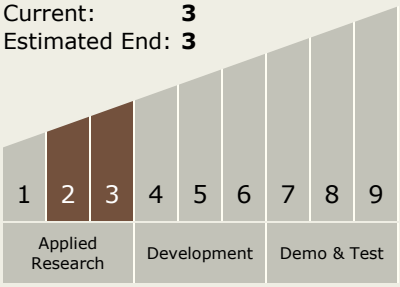
Hung D Nguyen

Principal Investigator:

Christopher M Hansen

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destination

Foundational Knowledge